Amendments to the Specification:

Please replace the paragraph beginning on page 12, line 3 through page 12, line 15, with the following rewritten paragraph:

FIG. 3 is a block diagram of an MCM transmitter and receiver that advantageously utilizes training tones, and a training tone tracking circuit 420 in a system 302 that tends to reduce phase noise. A training tone tracking circuit 420 accepts an input signal 417 and splits the signal into a first signal, and a second signal. The first signal is applied to a first input port of a mixer 407. The second signal is applied to a training tone tracking PLL (135) (TT PLL). An output of the TT PLL (135) is applied to a second input port of the mixer 407. An ~~output104~~output 104 of the mixer 407 is coupled to an MCM demodulator and ~~FFT415~~FFT 137. Input 417 of the TT PLL is coupled as described in FIG. 1. The remainder of the circuitry of FIG. 3 is identical to the circuitry described in FIG. 1.

Please replace the paragraph beginning on page 12, line 28 through page 12 line 33, with the following rewritten paragraph:

The ~~TTT~~TT PLL circuitry deduces what the phase noise is at any given instant and applies its negative to the received signal such that the phase noise tends to be canceled. The error in phase is recovered from a received signal, and its negative is applied to the received signal at a later time such that phase noise tends to be reduced.

Please replace the paragraph beginning on page 14, line 34 through page 15, line 12, with the following rewritten paragraph:

FIG. 5 is a block diagram of a second order phase lock loop used as a part of the training tone tracking PLL (135 of FIG. 3). The second order PLL is used as a carrier tracking PLL to reconstruct a training tone as it was transmitted, without phase error. The second order PLL is conventionally constructed utilizing components known to those skilled in the art. A signal fc is input to a phase detector 401. Also, a second input to phase detector 401 is a signal fref. The output of phase detector 401 is input to a loop filter 403. An output of loop filter 403 is an input to a frequency synthesizer 405. The output of frequency synthesizer 405 forms the signal fref that is the phase detector 401 input and a mixer 407 input $\cancel{S(n)e^{-j\phi(t)}}$ $\underline{e^{-j\phi(t)}}$.

Please replace the paragraph beginning on page 15, line 13 through page 15, line 24, with the following rewritten paragraph:

The phase lock loop is often used to purify a signal without appreciatively changing the signal. The purpose of the PLL in this application is to match an internally generated signal fref to a received signal $\cancel{fc(S(n)e^{j\phi(t)})}$ $\underline{fc = S(n)e^{j\phi(t)}}$. The purpose of the PLL is to produce a clean signal that is substituted for the received signal fc. Typically an incoming signal, such as fc, that is being replaced possesses one or more

undesirable properties such as jitter, phase noise or other undesirable properties. The signal fref that is internally generated based on fc tends to have the desirable property of being a smooth signal matched in frequency and phase with the input signal fc. Thus, fref tends to be a clean replica of fc.

Please replace the paragraph beginning on page 16, line 15 through page 17, line 26, with the following rewritten paragraph:

Returning to FIG.3, the input 417 to the training tone tracking PLL, (135 of FIG. 3), consists of a series of modulated carriers centered about base band 133. The carriers are not clean, a certain amount of phase noise or phase jitter is present on each of the down converted carriers. In the MCM the demodulator and FFT (~~415~~137 of FIG. 3), the instantaneous phase error determined by examining the training tone(s) will be subtracted from each of the N sampled carriers that makes up the N independent signals. The subtraction produces a series of N independent signals impressed on equally spaced carriers at the output 104 of the training tone tracking circuit 420. The carriers are relatively free of phase noise or jitter. Mathematically the process is as follows:

A series of k training tones are inserted into a MCM signal. The training tones are represented as:

$$T.T. = \text{TrainingTones} = e^{j2\pi kn/N}$$

where: k=0, 8, 16 . . . 1016

Each carrier is identically modulated by the tuner:

$$\left(\frac{k}{8}+1\right)^{st} \text{Training Tone} = \underbrace{e^{j2\pi kn/N}}_{\text{TrainingTones}} \cdot \underbrace{e^{j2\pi\varnothing(t)}}_{\text{PhaseNoise}} = e^{j2\pi\left(\frac{kn}{N}+\varnothing(t)\right)}$$

Where:

$e^{j2\pi kn/N}$ = Training tones

$e^{j2\pi\varnothing(t)}$ = Phase Noise

$$\varnothing(t) = \left[\int^{t} \varnothing_{RAND}(t)\,dt\right] \cdot (1-\alpha)$$

$\varnothing_{RAND}$ = a normal distribution random variable

α = a leakage factor

Phase error is determined by demodulating the training tone:

$$\text{T.T.} = e^{j2\pi(kn/N+\varnothing(t))}$$

$$\text{Phase error} = \text{T.T.} * e^{-j2\pi(kn/N)} = e^{j2\pi(kn/N+\varnothing(t)} \cdot e^{j2\pi(kn/N)}$$

$$\text{Phase error} = e^{j\varnothing(t)} = \text{Phase Angle}$$

The phase errors of all tones after demodulation are combined. For straight combining:

$$\text{Phase Error} = \frac{1}{(\text{Number of Training Tones})} \sum \text{T.T.} \cdot e^{j2\pi(kn/N)}$$

Please replace the paragraph beginning on page 18, line 3 through page 18, line 7, with the following rewritten paragraph:

The phase noise contribution which is identical to the phase noise of the k signals with phase noise is removed from the pilot tone. Next the negative of the phase noise of the

pilot is taken. The phase noise term is multiplied (407 of FIG. 5) with a distorted input signal $S(n)\cancel{ej^{\phi(n)}}\underline{e^{j\phi(t)}}$.

Please replace the paragraph beginning on page 18, line 34 through page 19, line 5, with the following rewritten paragraph:

A first embodiment of a phase detector ~~402~~401 processes training tones, a second embodiment of a phase detector relies on a combination of training tones and modulated data signals, and a third embodiment of a phase detector utilizes data signals only.

Please replace the paragraph beginning on page 20, line 5 through page 20, line 14, with the following rewritten paragraph:

Summing junction 605 includes an output 603 that consists of a signal representative of a phase. Input 603 is applied to a conventionally constructed complex exponential block input. An output of the complex exponential block 550 is a signal ~~ej5~~ $\underline{e^{j\phi(t)}}$ a complex value. Thus, a phase is input and a complex value phasor is output from block 550. The output of complex exponential block 550 is applied to an input of a mixer 551. Mixer 551 is conventionally constructed as known to those skilled in the art. A second mixer input to mixer 551 supplies a signal fref previously generated as shown in ~~FIG. 5a~~FIG. 5.

Please replace the paragraph beginning on page 24, line 24 through page 24, line 31, with the following rewritten paragraph:

Input 601 includes a series of tones centered about a baseband frequency that are applied simultaneously to a plurality of phase error circuits ~~601~~607, 609, 611. The phase error circuits are dedicated to processing a tone at f = 0, f = K, and a tone at f = N-8, respectively where N is the total number of carriers present. The outputs of each of the plurality of phase error circuits are coupled to a conventionally constructed summing junction 605. The summing junction 605 includes an output 603.